

***Radar Studies in the Solar System***

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***Strategy***

We are engaged in a study of the solar system by means of ground-based radar. We have concentrated on (i) developing the ephemerides needed to acquire radar data at Arecibo Observatory and (ii) analyzing the resultant data to: test fundamental laws of gravitation; determine the size, shape, topography, and spin vectors of the targets; and study the surface properties of these objects, through their scattering law and polarization characteristics.

***Progress and Accomplishments***

We have actively engaged in radar observations of asteroids and comets, both as systematically planned targets and as "targets of opportunity." During the past year, we attempted observations of four newly-discovered asteroids within a few weeks of discovery as well as three planned asteroids and two planned comets. Both attempts at comets failed, one because of a transmitter failure at Arecibo and the other because the target's radar cross-section was too low. The same two causes also prevented one asteroid attempt each, but two other attempts at observing new targets were highly successful. These observations took advantage of daily ephemeris refinements based on the available optical data beforehand and on the preliminary radar data during the observing run. The results are still being analyzed. The observing program also covered two of the four Galilean satellites of Jupiter and the satellites of Mars. In addition, progress was made in our ongoing effort to obtain "closure point" observations of Mercury, both at Arecibo and at the Goldstone radar operated by JPL. Finally, we have continued the analysis of radar data and prepared articles for publication in collaboration with our colleagues. Three papers were published, and analysis was begun on newly-acquired Venus radar data. Another paper, on 1986 DA, is in press.

***Projected Accomplishments***

We plan to continue our activities in this field, both by obtaining radar observations of asteroids, comets, planets, and satellites and by analyzing the data. We plan to refine the spin vector of Venus on the basis of recently acquired data; the result could be important in the interpretation of results from the Magellan mission.

### ***Publications***

Ostro, S.J., Chandler, J.F., Hine, A.A., Rosema, K.D., Shapiro, I.I., and Yeomans, D.K., *Science* 248, 1523-1528, 1990.

Ostro, S.J., Campbell, D.B., Hine, A.A., Shapiro, I.I., Chandler, J.F., Werner, C.L., and Rosema, K.D., *Astron. J* 99, 2012-2019, 1990.

Shapiro, I.I., Chandler, J.F., Campbell, D.B., Hine, A.A., and Stacey, N.J.S., *Astron. J* 100, 1363-1368, 1990.